eggs of Pallene were large, 0·25 mm., and well adapted for investigation. After a minute description of the early stages of development, the author considers that from them there is little or no ground for a comparison between the Pycnogonids and the Crustacea, certainly not with any existing forms. The multipolar delamination of the endoderm in the Pycnogonids has no homologue amongst the Crustacea, nor is there any special similarity in the formations of the organs. There seems to be no trace of gastrulation like that in the Crustacean in the ontogeny of the group. And if there be reason for rejecting a relationship between the Pantopod larva and the Nauplius, and with Dohrn he believes that there is, then there remains nothing in common to the ontogeny of the two groups.

Nor are there any special affinities between the insects and Pycnogonids; but between these latter and Peripatus a striking similarity is met with in the paired ventral organs, both in the structure and position of these, but for the present there is no proof forthcoming as to a real homology of these bodies. The process of the formation of the endoderm, as described by Heider and by Wheeler in insects, shows a certain resemblance to multipolar delamination; but if it be such, it is a more complicated form than is shown by the Pycnogonids. With these two exceptions there would seem to be nothing else in common in the ontogeny of the two groups.

Lastly, as to a decision as to the relationship with the Arachnids, or as to their being an independent phylum. While Dohrn and Hoek ably maintain the latter, though not agreeing as to the why in all details, yet the study of the early stages of the embryology has brought to light certain facts which lead the author of this memoir to believe in a community of descent between the two. The reasons for this belief are given in full detail, with difficulty admitting of abbreviation. The Pycnogonids form the endoderm by a process of multipolar delamination, which is shown in its simplest form in Phoxichilidium and Tanystylum, and in a more modified condition in Pallene. In no other group of the Triploblastica is a similar phenomenon found except in the Arachnids. In the spiders the process is not so well marked, but if Balfour's conception of the formation of the yolk nuclei be correct, then a direct comparison may be made between the two groups. The first trace of the embryo to appear in Pallene is a round opaque area at the spot where the stomodæum invaginates. In Schimkewitsch's recent account of the development of the spiders, he shows that the primitive cumulus in them is the place where the stomodæum invaginates; and in calling attention to the fact that the stomodæum of spiders in its earliest development is a triangular invagination, he actually compares it with the triangular invagination of the œsophagus of the Pycnogonids. It is also exceedingly probable that the early formation of the body cavity surrounded by mesoblast in the legs of spiders has an exact parallel in Pallene and Phoxichilidium. In both Arachnids and Pycnogonids there are well-marked diverticula from the mid gut into the legs. In both Arachnids and Pycnogonids the first pair of appendages are chelate, and in both this first pair is innervated from the brain; these facts alone, it will be remembered, were considered by Balfour to indicate a relationship between the groups. Mr. Morgan was unable to find any post-oral ganglia for Pallene, but the first pair of appendages arises on the sides of the stomodæum and moves forward later. In this respect, it compares closely with the spiders, and the early innervation of this pair from the brain itself may be regarded as a more abbreviated condition than what was seen (by Balfour) in the spiders. Metchnikoff's figures for Chelifer show the first pair of appendages to arise above and on each side of the proboscis-like upper lip, and if future investigation verifies Metchnikoff's suggestion that this proboscis is homologous, entirely or in part, to the proboscis of the Pycnogonids, as his figure seems to indicate, then does the whole development of the Chelifer show remarkably close resemblances to that of the Pycnogonids. The fourth pair of ambulatory legs—the seventh pair of appendages—has been a stumbling-block in the way of an Arachnid relationship, and the attempts to solve the difficulty have been many. Here, again, Balfour's suggestion that this last segment and its appendages may represent the first abdominal segment of the Arachnids is of value, as we know that the embryos of spiders have rudimentary appendages on the abdomen. In a second part of this memoir the metamorphosis of Tanystylum is described, and in a third part we have a very complete study of the structure and development of the eyes of Pycnogonids and a comparison with the Arachnid simple eyes, a comparison that seems to verify the relationship pointed out in the first part of the memoir. E. P. W.

A TEXT-BOOK OF CHEMISTRY BASED ON THE PERIODIC SYSTEM.

A System of Inorganic Chemistry. By William Ramsay, Ph.D., F.R.S. Pp. 700. (London: J. and A. Churchill, 1891.)

DURING the twenty-five years or so which have elapsed since the recognition of the periodic law of the chemical elements as a valid relationship, the pronounced influence which it has exercised both on the aspect and aims of chemical science cannot be questioned. Whether in the prediction of undiscovered elements, or as an indicator of needful research, especially in the department of atomic weight estimations, it has met with signal success. In connecting the physical properties of the elements themselves and of their compounds with atomic weight, it has opened up new fields of investigation, and thrown fresh interest into old ones. Properties so widely different as those measured by refraction equivalent and breaking stress find an explanation, nowadays, in the magnitudes of the atomic weights.

As a means of classification, too, the success of the periodic arrangement has not been less striking. Indeed, to its power as an instrument of classification it owes its general acceptance in the first instance. When the ideas of Avogadro had become recognized, and by their means the old system of "equivalents" had been replaced by the true atomic weights, then the periodic arrangement resulted in a grouping of the elements so much in harmony with existing notions of their relationships, that the far-reaching power of the generalization could no longer be resisted.

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The distinguishing feature of the book before us consists in the use of the periodic arrangement as a means of classifying the subject-matter of inorganic chemistry. Here, the time-honoured methods of putting the facts and theories of chemistry before the student are set aside, and as the method adopted is novel to English text-books, it may be advisable to consider its characteristics. After a short historical introduction, the author proceeds to describe the occurrence, preparation, and properties of the elements in the order in which they are found in the periodic table. First, Group I., hydrogen and the alkali metals; then Group II., metals of the alkaline earths, and so forth. The descriptions refer, as far as possible, to the elements of the same group taken collectively.

The compounds of elements of the different groups with the halogens form the next part, and in the introductory portion the student meets for the first time with matter which it is customary to discuss at an earlier stage in the text-books; such matter as the distinction between element and compound, the use of chemical symbols, the gaseous laws, &c. The fourth part deals with the oxides, sulphides, selenides, and tellurides, and under these headings are to be found hydroxides, hydrosulphides, &c., classed as compounds of the oxides with water, hydrogen sulphide, &c. Here, also, are treated the salts of the oxyacids, classed as double oxides, and compounds as $POCl_3$ treated as double compounds with the halogens.

Part v. gives an account of the borides, carbides, and silicides; such of the hydrocarbons as are considered, and the organo-metallic compounds occur in this part. Compounds with the elements of the nitrogen group, including the cyanides, form Part vi. Alloys and amalgams are discussed in Part vii. The first chapter of the next part gives a short account of spectrum analysis and the rare earths. The second chapter is chiefly concerned with the criteria for fixing atomic and molecular weights, the Raoult methods finding a place, and the last chapter is devoted to the periodic law. The closing part of the book takes up, mainly with regard to the chemical principles involved, the manufacturing processes usually treated in the text-books.

It will be seen, as the author states in his preface, that the method adopted does away with the distinction between metals and non-metals; no special stress is laid on the properties of acids as contrasted with bases; equal prominence is given to rare and more common substances; and the commercial importance of a substance or process is not considered an argument for its special consideration.

Such a work as this may be looked at from two points of view. Regarded as a systematic arrangement of the facts of inorganic chemistry, from which any desired information may be speedily taken after one has become familiarized with the method of classification adopted, its success is undoubted. The book is quite in touch with recent investigations, nothing of importance seems to be omitted from the descriptive portion, and, what is a recommendation to a large class of readers, the size of the book is not excessive. Whatever be the results of the system adopted, economy of space is assuredly achieved. To the teacher or to the advanced student who wishes to use the book as a work of reference, or desires to systematize his knowledge, it will be eminently useful.

If, on the other hand, the system be regarded from the point of view of a basis for teaching, its construction from its very novelty must be open to discussion. A method of teaching chemistry often employed may be said to consist in giving the learner in as easy a manner as possible the leading facts of chemical science with regard, in the first instance, more to the correct appreciation of the meaning of the facts themselves, than of the exact arrangement or classification of the same. To this end the student is led from the study of the chemical properties of commonly occurring bodies to the description of the elements contained in them, explanations of chemical terms being given as they crop up, or in short reviews at intervals not far apart. When the properties of the elements are being explained, their reactions with other elements have to be noticed, and hence it appears natural to describe the important compounds of an element after its own properties have been discussed. The periodic system does not seem to provide the means for such a course of teaching, and this appears to us to be the main reason for its non-adoption in the text-books.

Indeed, the new method has little in common with that indicated above. The entire series of the elements apart from their compounds are described, and chemical and physical terms are freely used without any attempt being made to define them till all the elements have been treated. In fact, a few terms, as critical point and heat of formation, are used, but as far as we can see, not defined in the book. Again, compounds containing a common constituent are classed together, but compounds of what may be taken as a parent element are scattered throughout the various groups. Surely, in connection with this point, reasons similar to those which lead to the grouping of compounds containing the same element, on the new system, would hold for the old method of considering compounds. The position of the iron group of elements after the aluminium group and of the copper group—the last one described—may be taken as an indication that even in the author's opinion the periodic law does not in all cases indicate most clearly the relationships of the elements. Such considerations as these must weigh with a teacher before he can adopt the system; during four years' experience, however, the author has had no reason to doubt its success.

The book is clearly printed, and the illustrations, though not very numerous, are for the most part new. The frequent use of vapour jackets in the apparatus represented is suggestive of the author's more recent contributions to scientific literature. The useful system adopted by Ostwald in his "Lehrbuch," of indicating the state of aggregation of a substance by the type, has been employed.

Setting aside the points which may be urged against the work as a basis for teaching, the periodic law, as expounded by Prof. Ramsay, does more than any other system of classification to put the matter of inorganic chemistry on a footing resembling that which holds for organic chemistry.

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